RECORD 552/B

PATENT SPECIFICATION (11) 1 499 687

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(21) Application No. 43945/75 (22) Filed 24 Oct. 1975 (19)
(23) Complete Specification filed 20 Oct. 1976
(44) Complete Specification published 1 Feb. 1978
(51) INT. CL.² D01G 25/00
(52) Index at acceptance
D1N 1D

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(54) APPARATUS FOR DRY FORMING A LAYER OF FIBRE

(71) We, KARL KROYER ST. ANNE'S LIMITED, a British Company of St. Anne's Road, Bristol, BS4 4AD, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to apparatus for dry forming a layer of fibre.

The apparatus is of the kind comprising a distributor box having an inlet for fibre and a perforated bottom wall and a movable foraminous forming surface, e.g. an endless wire belt conveyor, which is spaced below the bottom wall and arranged to receive the fibre through the bottom wall under the influence of suction exerted by a suction system which connects with the under side of the forming surface, e.g. through a suction box. A problem associated with the use of such known apparatus is the "profile" or cross-section of the layer of fibre laid on the foraminous forming surface. It has been found that differing quantities of fibre are delivered by the distributor box onto the foraminous forming surface such that the thickness and weight of fibre across the foraminous forming surface will vary considerably, e.g. of the order of plus or minus 18% in a typical dry forming situation. This variation may be unacceptable.

A large number of variable factors are thought to affect the distribution of fibre on to the forming surface, the more important being the design of the distributor box, the type, speed and direction of rotation of rotary agitators which may be used to agitate the fibre within the box, the size of perforations in the bottom wall of the box, the vertical air gap between the bottom wall and the forming surface, the weight and form of fibre used, the degree of suction applied to the forming surface, and the linear speed of the forming surface past the distributor. By altering one or more of these variable factors it may be possible to adjust the "profile" of the fibrous layer which is laid upon the forming surface to, say, plus or minus 6% but such substantial uniformity is achieved only with difficulty.

The distribution of fibre upon the bottom wall of the distribution box has a significant effect on the "profile" of the fibre layer laid. It has been found that the agitated bed of fibre within the distributor box can be starved adjacent the rotary agitators compared with the bed adjacent the periphery of the distributor box. This problem can be overcome by increasing considerably the depth of the fibre bed to ensure the rotors are always covered. However, this can result in an excessive amount of fibre being held within the distributor box such that the suction applied to the forming surface cannot draw sufficient fibre through the bottom wall of the distributor box.

A fixed depth of bed could be arranged but this would suffer from the disadvantage that the depth needed would vary with parameters mentioned above, in particular the type of fibre used, the air flow and the suction applied to the apparatus.

It is an object of the present invention to provide a distributor box which is readily adjustable by the operator to provide a laid fibre layer having a selected "profile" which is within commercially acceptable limits.

According to the present invention, there is provided apparatus for dry forming a layer of fibre comprising

(a) a distributor box having a bottom wall which is perforated for the passage of fibre, an inlet above the bottom wall for receiving a supply of air-borne fibre which forms a fibre bed on the bottom wall, and an outlet through which is drawn off excess fibre from the top of the fibre bed,

(b) means for agitating the fibre bed to distribute fibre across the bottom wall,

(c) a movable foraminous forming surface below the bottom wall for receiving fibre through the bottom wall,

(d) and a suction system which connects

with the underside of the forming surface for sucking fibre down on to the forming surface, wherein means are provided for controlling the distance between the bottom wall and the outlet to vary in operation the depth of the fibre bed.

The invention is illustrated by way of example in the accompanying drawings, in which,

Figure 1 is a vertical section through a distributor box,

Figure 2 is a vertical section through the distributor box at right angles to the section of Figure 1.

Figure 3 is a horizontal section through the distributor box, and

Figure 4 is a vertical section through another distributor box.

Referring to the drawings, there is shown in Figures 1 to 3 a distributor system substantially similar to that described in our co-pending Application No. 23369/75 (Serial N. 1,497,808) and comprising an elongate distributor box 10 having an inlet 11 in the form of a horizontal slot, an apertured top wall 9 and a perforated flat bottom wall 12. Within the box 10 are disposed a plurality of rotary agitators in the form of rotors 13 mounted on the lower ends of parallel vertical shafts 14. Raw fibre is fed by a stream of carrier air to the box 10 through a divergent feed duct 15 which connects with inlet 11 above the rotors 13.

Two outlets 16 connecting with ducts 17 are provided at opposed ends of the box 10 for drawing off by suction fibre in excess of the requirements of the distributor box. The excess fibre may be recirculated to the inlet 11.

Slightly spaced below the perforated bottom wall 12 is a foraminous forming surface 20 in the form of an endless wire belt conveyor below which is a suction box 21 adapted to apply suction to the under side of the forming surface 20.

The fibre borne by carrier air enters the inlet 11 and descends to the bottom wall 12. The operation of the rotors 13 agitates the fibre and distributes it across the bottom wall in the form of an agitated bed. The operation of the suction box 21 sucks fibre down through the perforated bottom wall 12 and onto the travelling forming surface 20. The direction of travel of the latter is indicated by the horizontal arrow in Figure 2.

It has been found that the fibre layer laid on the forming surface 20 is not always of uniform depth as seen in cross-section. One cause of this is that the fibre bed on the bottom wall 12 is not of uniform depth, a shortage of fibre occurring at each zone swept by a rotor 13. To overcome this problem and also provide a depth of bed control for the operator the box 10 is made capable of varying the height of the effective areas of the outlets 16 above the bottom wall 12. In Figures 1—3 this is achieved by providing a sleeve 40 disposed around the inner surface of a side wall section 41 of the box between the bottom wall 12 and the outlets 16. The sleeve which preferably is in sliding contact with the section 41 is displaceable upwards or downwards between a bottom position as shown in full line and a top position as partly indicated in broken line. The sleeve 40 has a downwardly-inclined internal flange 42 around its upper edge but this flange is not essential to the working of the invention. Any suitable actuator for controlling the position of the sleeve may be used. In this example the sleeve movement is controlled closely by a pair of manually adjustable vertical screws 43 secured at their lower ends to lugs 44 on the sleeve. When the screws 43 are turned the upper portion of the sleeve moves partly across the outlets 16 effectively forming a weir or step over which excess fibre from the top of fibre bed must pass to reach the effective areas of the outlets 16 and be sucked away through the ducts 17. In this manner the effective height of the outlets 16 and so the depth of the fibre bed can be readily selected, care being taken that there is sufficient depth of bed to avoid relatively bare patches beneath the rotors 13 but not too great a depth to hinder the suction exerted by the suction box 21. Typically, the range of displacement of the control sleeve 40 is about eight inches.

A small air gap 30 exists between the botom wall 12 and the forming surface 20 and in operation the suction exerted by the suction box 21 causes inward lateral flows of ambient air into the gap which can adversely affect the uniformity of cross-section of the fibre layer being laid. For this reason the distributor box is preferably also provided with means for at least partly restricting these upsetting flows. Such means may take the form of two opposing series of obturator flaps 35 pivotably mounted on horizontal rods 36 supported respectively from the upstream and downstream bottom edges of the box 10. The flaps 35 normally hang down vertically as shown in full line but in operation are inclined inwards substantially as shown in interrupted line. The flaps are free to vibrate or flutter under the influence of the air flow about them and this prevents build-up of fibre on them. The flaps can be slid along their respective rods 36 across the box 10 so that during the commencement of operation the operator can readily adjust the position of the flaps according to the strength of the lateral air flows which develop within the gap 30. The flaps are also provided with an inoperative position to which they can be pivoted upwards.

Referring to Figure 4 the same reference numerals are used where appropriate. Again the optional obturator flaps 35 are provided. In this embodiment the distributor box is of telescopic construction, being divided into a fixed lower portion 50 and a vertically displaceable upper portion 51. The lower portion 50 includes the bottom wall 12 and side wall section 41 and houses the rotors 13. The upper portion 51 carries apertured members defining the outlets 16, ducts 17 and at its lower end a sleeve 52 having a top flange 53. The sleeve 52 is preferably in sliding contact with the inner surface of the section 41. The fixed duct 15 is connected to the inlet 11 by a flexible section which accommodates vertical movement of the upper portion 51. Means (not shown) for raising and lowering the upper portion 51 may be similar to those shown in Figures 1 to 3. To cause an increase in the depth of the fibre bed on the bottom wall 12, the upper portion 51 is raised from its position shown taking with it the outlets 16. The upper edge of the flanged sleeve 52 which meets the lower edge of each outlet 16 provides a weir or step over which excess fibre must pass to reach the outlets 16 and be sucked away. Conversely, to cause a reduction in the depth of the fibre bed the upper portion 51 is lowered into the lower portion 50.

In a further embodiment of the invention the control sleeve 40 of the distributor box 10 is replaced by two opposing obturators, one for each outlet 16, which obturators are displaceable upwards or downwards by manually-adjustable means, their respective upper edges forming weirs or steps over which excess fibre must pass to enter the ducts 17. The obturators may be separate plates curved to match the outlets 16 at the curved ends of the distributor box. Instead of the rotors 13, the distribution box 10 may be provided with any other means for ensuring agitation of the fibre bed adjacent the bottom wall 12, for example the bottom wall 12 may be supported on rubber mountings located within the box and arranged to be suitably vibrated.

WHAT WE CLAIM IS:—

1. Apparatus for dry forming a layer of fibre comprising

(a) a distributor box having a bottom wall which is perforated for the passage of fibre, an inlet above the bottom wall for receiving a supply of air-borne fibre which forms a fibre bed on the bottom wall, and an outlet through which is drawn off excess fibre from the top of the fibre bed,

(b) means for agitating the fibre bed to distribute fibre across the bottom wall,

(c) a movable foraminous forming surface below the bottom wall for receiving fibre through the bottom wall,

(d) and a suction system which connects with the underside of the forming surface for sucking fibre down on to the forming surface, wherein means are provided for controlling the distance between the bottom wall and the outlet to vary in operation the depth of the fibre bed.

2. Apparatus according to claim 1, wherein the outlet is a lateral outlet and the control means comprises a sleeve disposed around the inner surface of a side wall section of the distributor box between the bottom wall and the outlet, which sleeve is displaceable upwards or downwards to a selected position, an upper portion of the sleeve forming a weir over which excess fibre from the fibre bed must pass to reach the outlet.

3. Apparatus according to claim 2, in which the sleeve is slidable upwards or downwards along the side wall section.

4. Apparatus according to claim 2, wherein the upper end of the sleeve is connected to an apertured member which defines the outlet.

5. Apparatus according to claim 2, wherein the distributor box comprises a fixed lower portion which includes the bottom wall and the side wall section and an upper portion which comprises the sleeve and an apertured member which defines the outlet, which upper portion is partly overlapped by the side wall section of the lower portion and is displaceable upwards or downwards to control the distance between the bottom wall of the lower portion and the outlet of the upper section.

6. Apparatus according to claim 1, wherein there is a pair of opposing outlets through which is drawn off the excess fibre.

7. Apparatus according to claim 1, wherein the outlet is a lateral outlet and the control means comprises an obturator adjacent the outlet which is displaceable upwards or downwards to a selected position, an upper portion of the obturator forming a weir over which the excess fibre from the fibre bed must pass to escape through the outlet.

8. Apparatus according to claim 1, wherein the flow of ambient air drawn in operation into an air gap between the bottom wall and the forming surface is at least partly controlled by flaps which are dependant from pivot supports adjacent the bottom periphery of the distributor box, which flaps are free to vibrate under the influence of air flow about them.

9. Apparatus according to claim 1, wherein rotary agitator means are provided in the distributor box to provide an agitated fibre bed on the bottom wall.

10. Apparatus according to claim 1, wherein the bottom wall of the distributor box is constructed and arranged to be vibrated to agitate the fibre bed.

11. Apparatus substantially as described herein with reference to Figures 1 to 3, or Figure 4, of the accompanying drawings.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1978.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.

1499687 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

FIG. 1.

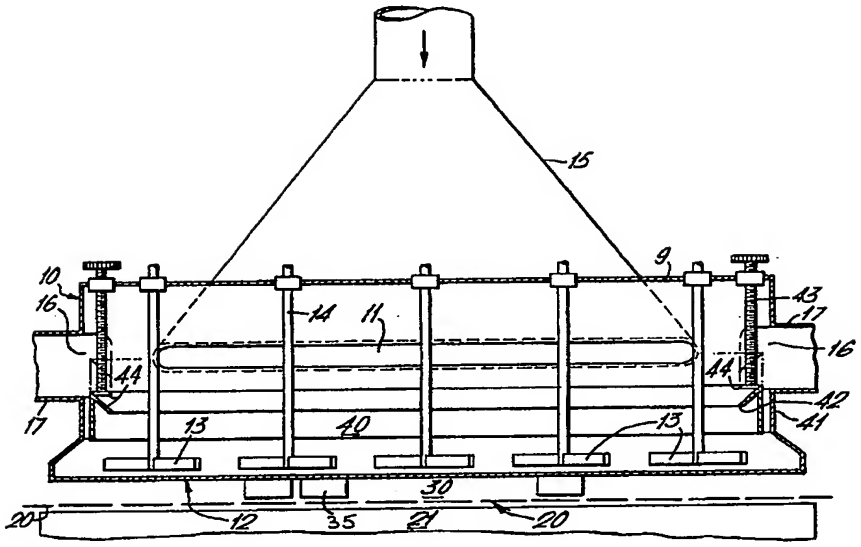
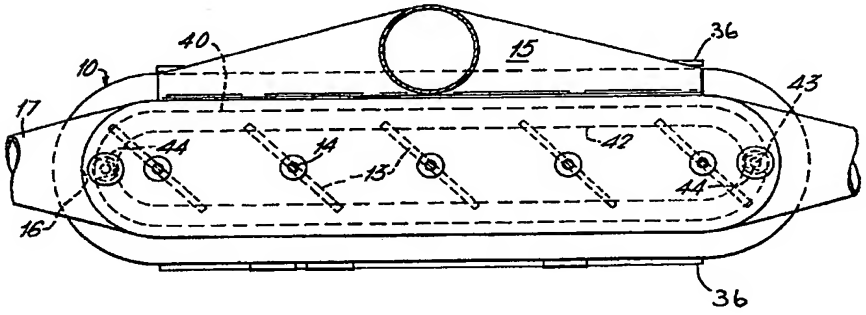


FIG. 3.



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2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

FIG. 2.

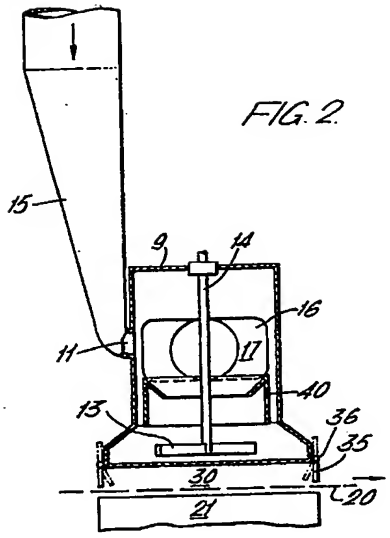

FIG. 4.